# NOTES ON THE NATIVE FLORA OF NEW SOUTH WALES.

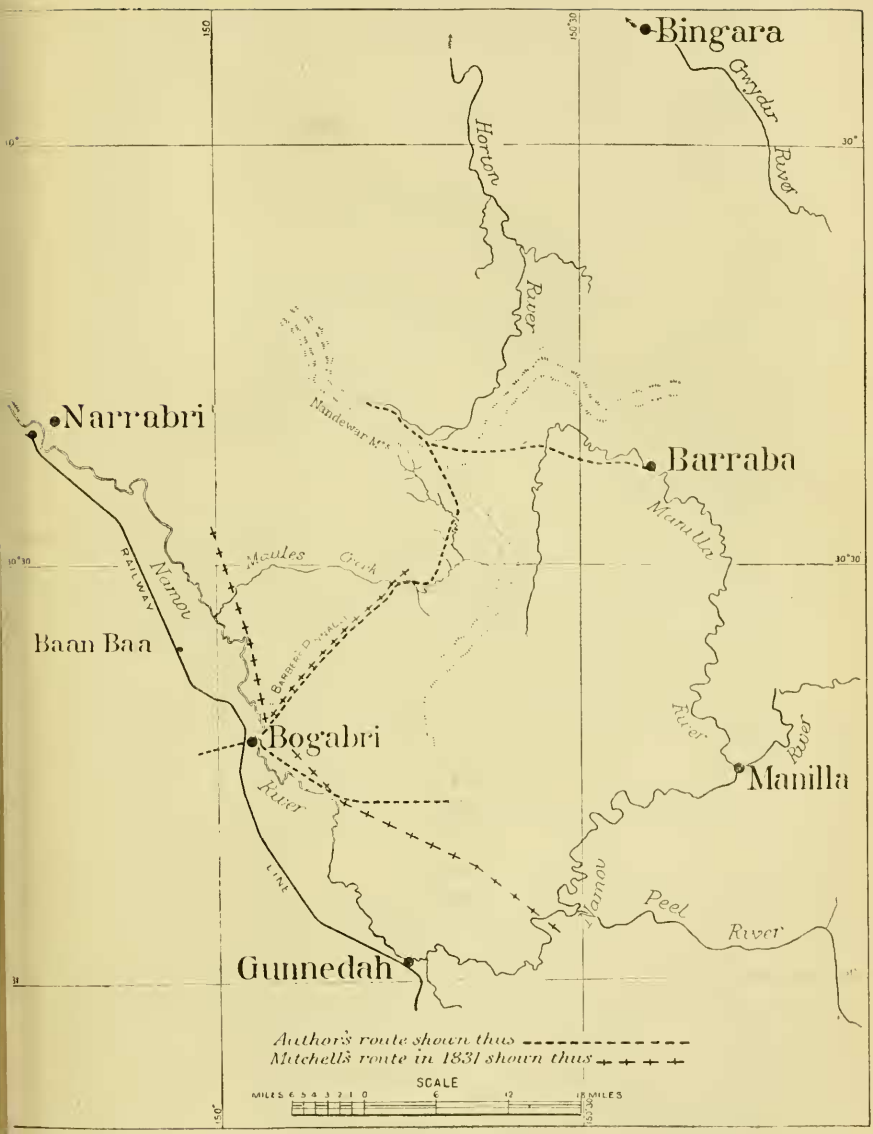
By R. H. Cambage, F.L.S.

## Part ix. Barraba to Nandewar Mountains and Boggabri.

(Plates lxvi.-lxvii.)

The notes for this paper were obtained during a short visit to the locality in November, 1909, and although many small plants were doubtless overlooked, sufficient were noticed to enable a good general impression of the character of the vegetation to be formed. One of the chief features of interest of the locality, from a geographical standpoint, is that, although the Nandewar Mountains are situated about 90 miles west of the Great Dividing Range, and are connected with New England by the Nandewar Range, which is in places a comparatively low spur, yet they reach an altitude of about 5,000 feet above sea-level, an elevation only exceeded in a few instances in New South Wales, outside the Kosciusko and surrounding area. It is this elevation, and partial isolation, which give additional interest to the locality from a botanical point of view, for the increased height enables plants to flourish there, which would otherwise be absent from the district; while the isolation makes it both difficult and interesting to account for some of the species being there at all.

The Nandewar Mountains were discovered by Surveyor-General Oxley on the 8th August, 1818, when on his exploratory journey easterly from the Macquarie River to Port Macquarie. As an evidence of their comparative height, and the generally lower nature of the intervening country, they were first seen and named from a distance of upwards of one hundred miles. Oxley had just previously discovered the Warrumbungle Mountains, which he named Arbuthnot's Range, and he writes, that when standing on Mount Exmouth, the highest point of the Warrum-


Bingara
Gwydir River
Horton River
Narrabri
Mandewar Mts
Barraba
Manilla River
Maules Creek
Namoi River
RAILWAY
Baan Baa
BARRIER RANGE
Bogabri
River
Manilla
River
LINE
Namoi
Peel River
Gunnedah
Author's route shown thus
Mitchell's route in 1831 shown thus
SCALE
MILES 6 5 4 3 2 1 0 6 12 18 MILES

bungles, and which has an elevation of over 4,000 feet :—"To the north-east, commencing at N.33°E., and extending to N.51°E., a lofty and magnificent range of hills was seen lifting their blue heads above the horizon. This range was honoured with the name of the Earl of Hardwicke, and was distant on a medium from one hundred to one hundred and twenty miles: its highest elevations were named respectively Mount Apsley and Mount Shirley."* Accompanying Oxley, on this expedition, was Charles Fraser, Colonial Botanist, who collected many new species of plants. Oxley passed to the south of Hardwicke's Range, now known as the Nandewar Mountains, and on 2nd September, 1818, discovered and "named Peel's River, in honour of the Right Hon. Robert Peel,"(p.248), and which he crossed near Gidley, to the north-west of Tamworth. The native name of the river is Callala.

*Allan Cunningham.*—The second botanist to visit the vicinity of the Nandewar Mountains, was Allan Cunningham, who passed northwards near Barraba and Bingara in May, 1827, when on his journey from the Upper Hunter to Queensland, which resulted in his discovery of the Darling Downs. On returning in the following July, he crossed the Gwydir River some 10 miles below its junction with Horton's River, discovering and naming both rivers during this expedition, the former in honour of the Right Hon. Lord Gwydir, and the latter in honour of R. J. Wilmot Horton, M.P., Under Secretary of State for the Colonies. In continuing his journey southwards, partly up Horton's River, Cunningham passed over the Nandewar Range and over the eastern spurs of the Nandewar Mountains, which latter he referred to as Hardwicke's Range, and spoke of the elevations as "curiously formed cubical and chimney-shaped summits."†

*Surveyor-General Sir Thomas L. Mitchell.*—The third explorer to visit the neighbourhood of the Nandewar Mountains, was Sir

* Oxley's Expedition, p.261. According to Oxley's map, the northern elevation was named Apsley, and the southern, Shirley, and they were about 17 miles apart.

† Journal of the Royal Geographical Society, London, Vol. ii., p.115, with map.

Thomas L. Mitchell, in December, 1831, but he kept along the western side, and refers to them throughout as the Nundawàr Range, this evidently being the native name, although Mitchell does not say so in his journal. He gives an outline drawing of these mountains as viewed from the westward, and quotes names for the most prominent peaks from north to south in the following order:—Riddell, Couràda, Lindesay, Kaputar, and Forbes. Mitchell writes:—"That great range terminates in three principal heads, of which Mounts Riddell and Forbes are the northern and southern, the central or highest being named Mount Lindesay."* Mount Forbes, which is near the south-western extremity, was named after Captain Forbes, of the 39th Regiment, and it is not unlikely that Mount Lindesay was named after the then Acting Governor, Sir Patrick Lindesay, while Couràda is a native name. Mount Kaputar, or more especially the bluff towards its south-eastern side, is now locally known as Mount Lindsay (spelt without an e).

Barraba occupies an area of Devonian and Carboniferous formations, the former containing fairly abundant fossils of *Lepidodendron australe*, and is about 1,650 feet above sea-level. From Barraba past May Vale to Mount Lindsay Station is a distance westerly of nearly 30 miles, the altitude at the homestead being about 3,000 feet, and the ascent from May Vale, which is situated about half-way, nearly 1,000 feet. Carboniferous shales are met with between Barraba and May Vale, and afterwards areas of basalt and acid volcanic agglomerates are passed.

The Nandewar Mountains consist of a series of peaks composed largely of alkaline rocks, and which have, for the most part, a general N.N.west and S.S.east direction, while the western side presents a steep face towards the plains around Narrabri.†

From the eastern side, a range less than 2,500 feet high in places, and known as the Nandewar Range, passes between Barraba and Bingara and connects with southern New England.

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* Mitchell's Eastern Australia, Vol. i., p.136.

† For a paper on "The Geology of the Nandewar Mountains" by H. I. Jensen, D.Sc., see These Proceedings for 1907, p.842.

Plants were collected by the roadside from Barraba to Mount Lindsay Station, on the head of the Horton River, and also on the alkaline and acid rocks up to elevations of about 5,000 feet, and including the summit of Kaputar. From the homestead, the route afterwards followed was partly down Maule's Creek from near its source, over rhyolites and Permo-Carboniferous formation, and some black-soil plains to the Namoi River at Boggabri which is about 820 feet above sea-level.

*Rainfall.*—According to the records at the Sydney Observatory, the following are the average rainfalls, and the number of rainy days at some localities in and around the area described in this paper. The figures are:—

| | Inches. | Rainy days. |
|---|---|---|
| Manilla | 26·5 | 64 |
| Barraba | 27·4 | 49 |
| Bingara | 30·5 | 78 |
| May Vale | 31·3 | 79 |
| Mount Lindsay Station | 36·5 | 60 |
| Gunnedah | 25 | 64 |
| Boggabri | 23·5 | 59 |
| Narrabri | 26·5 | 57 |

*Barraba to May Vale.*

During a hurried drive from Barraba to May Vale, at elevations varying from about 1,650 to 2,000 feet, the following plants were noticed:—

Ranunculaceæ: *Ranunculus lappaceus* Sm.(Buttercup), *R.* sp.

Dilleniaceæ: *Hibbertia linearis* R.Br.

Malvaceæ: *Modiola multifida* Moench (introduced), *Pavonia hastata* Cav.

Leguminosæ: *Swainsona tephrotricha* F.v.M., *Hardenbergia monophylla* Benth.(False Sarsaparilla), *Acacia armata* R.Br.

Rosaceæ: *Rubus parvifolius* L.

Myrtaceæ: *Angophora subvelutina* F.v.M.(Apple Tree), *Eucalyptus melliodora* A. Cunn.,(Yellow Box), *E. albens* Miq.,(White Box), *E. tereticornis* Sm.,(Forest Red Gum), *E. melanophloia* F.v.M., (Silver-leaved Ironbark), *E. macrorrhyncha* F.v.M.,

(Stringybark), *E. Bridgesiana* R. T. Baker, (one of the trees recognised by Baron von Mueller as *E. Stuartiana* F.v.M.; the name is still retained by Mr. Maiden).

UMBELLIFERÆ : *Hydrocotyle hirta* R.Br.

RUBIACEÆ : *Asperula oligantha* F.v.M.

COMPOSITÆ : *Leptorrhynchus squamatus* Less., *Helichrysum apiculatum* DC., *Helipterum anthemoides* DC.

GOODENIACEÆ : *Velleya paradoxa* R.Br.

CAMPANULACEÆ : *Wahlenbergia gracilis* DC.,(Blue Bell).

VERBENACEÆ : *Verbena officinalis* L.

LABIATÆ : *Ajuga australis* R.Br.

THYMELEÆ : *Pimelea glauca* R.Br., *P. curviflora* R.Br.

EUPHORBIACEÆ : *Adriana tomentosa* Gaud.

URTICEÆ : *Urtica incisa* Poir.,(Nettle).

CASUARINEÆ : *Casuarina Cunninghamiana* Miq.,(River Oak).

CONIFERÆ : *Callitris calcarata* R.Br.,(Black Pine).

LILIACEÆ : *Xerotes longifolia* R.Br., *X. multiflora* R.Br., *Arthropodium strictum* R.Br.

CYPERACEÆ : *Cyperus vaginatus* R.Br.

*Eucalyptus melanophloia*, the Silver-leaved Ironbark, is a fairly common tree on the lower parts of the western slopes of New England, coming up from the Narromine district towards Boggabri and Bingara, and though absent fram the table-land, it occurs again on the eastern watershed, being common on the Upper Clarence east of Wilson's Downfall. Although plentiful all around the Nandewars, it was not noticed at or above the 3,000 feet level.

*Casuarina Cunninghamiana*(River Oak), though common on the large creeks around Barraba and at May Vale, was absent from the head waters of the Horton River at the 3,000 feet level, and apparently does not ascend much above an altitude of 2,800 feet in this latitude.

*The Nandewar Mountains.*

The following plants were found on the Nandewar Mountains from May Vale to the summit of Mount Kaputar (locally called Lindsay), and chiefly at altitudes between 3,000 feet, around Mount Lindsay Homestead, and 5,000 feet at the summit of the

Nandewars. Authors' names not repeated, were previously used for the same plant.

RANUNCULACEÆ: *Clematis glycinoides* DC., *Ranunculus lappaceus* (Buttercup), *R. plebeius* R.Br.

DILLENIACEÆ: *Hibbertia acicularis* F.v.M., *H. serpyllifolia* R.Br., *H. linearis*.

VIOLARIEÆ: *Viola betonicæfolia* Sm., (Wild Violet), *V. hederacea* Labill., (Wild Violet), *Ionidium filiforme* F.v.M.

PITTOSPOREÆ: *Pittosporum undulatum* Vent., (scarce), *Billardiera scandens* Sm., (Roly Poly Vine).

TREMANDREÆ: *Tetratheca ericifolia* Sm.

POLYGALEÆ: *Comesperma sylvestre* Lindl.

CARYOPHYLLEÆ: *Stellaria pungens* Brongn., *S. flaccida* Hook., (with leaves unusually narrow).

HYPERICINEÆ: *Hypericum gramineum* Forst.

MALVACEÆ: *Modiola multifida* (Naturalised).

STERCULIACEÆ: *Sterculia diversifolia* G.Don, (Currajong).

GERANIACEÆ: *Geranium dissectum* L., var. *potentilloides*, *Erodium cicutarium* Willd., *Oxalis corniculata* L., (Sour Grass).

RUTACEÆ: *Asterolasia correifolia* Benth., var. *Muelleri* F.v.M., (*A. Muelleri* Benth.), *Correa speciosa* Andr.

STACKHOUSIEÆ: *Stackhousia linarifolia* A. Cunn., *S. viminea* Sm.

RHAMNEÆ: *Cryptandra amara* Sm., *Discaria australis* Hook.

SAPINDACEÆ: *Dodonæa viscosa* L., and var. *attenuata* (Hopbush).

LEGUMINOSÆ: *Oxylobium ellipticum* R.Br., (?) var. *minor* (at 4,500 feet), *Gompholobium Huegelii* Benth., var. *leptophyllum*, *Daviesia latifolia* R.Br., *D. ulicina* Sm., *Pultenæa scabra* R.Br., *P. setulosa* Benth., *Dillwynia ericifolia* Sm., var. *phylicoides*, *Hovea linearis* R.Br., *Indigofera australis* Willd., (Indigo), and var. *platypoda*, *Glycine clandestina* Wendl., *Hardenbergia monophylla*, *Acacia lanigera* A. Cunn., (at 4,600 feet), *A. armata*, *A. neriifolia* A. Cunn., *A.*

*obtusata* Sieb., *A. rubida* A. Cunn., *A. lunata* Sieb., *A. viscidula* A. Cunn., (at 4,500 feet), *A. melanoxylon* R.Br., (Tasmanian Backwood), *A. dealbata* Link, (Silver Wattle).

ROSACEÆ: *Rubus parvifolius.*

CRASSULACEÆ: *Tillæa verticillaris* DC.

HALORAGEÆ: *Haloragis* sp.

MYRTACEÆ: *Calythrix tetragona* Labill., *Micromyrtus microphylla* Benth., (at 4,600 feet), *Leptospermum flavescens* Sm., *L. scoparium* Forst., (A Teatree), *L. stellatum* Cav., (?), *Kunzea opposita* F.v.M., *Angophora subvelutina* (Apple Tree), *A. intermedia* DC., (Apple Tree), *Eucalyptus coriacea* A. Cunn., (Scribbly Gum, Snow Gum of Kosciusko and Kiandra), *E. dives* Schauer, (Peppermint), *E. Andrewsi* Maiden, (a Peppermint), *E. nova-anglica* Deane and Maiden, (Red Peppermint), *E. Bridgesiana*, *E. macrorrhyncha* (Stringybark), *E. melliodora* (Yellow Box), *E. albens* (White Box), *E. Cambagei* Deane and Maiden, (Bundy of Burraga and Bathurst districts), *E. viminalis* Labill., (Manna Gum), *E. rubida* Deane and Maiden, (White Gum, chiefly a multiflowered form; *E. Gunnii* var. *rubida* Maiden), *E. tereticornis* (Forest Red Gum), *E. Bancrofti* Maiden, (*E. tereticornis* var. *brevifolia* Benth., Brittle, or Tumbledown Gum).

UMBELLIFERÆ: *Hydrocotyle hirta.*

ARALIACEÆ: *Panax sambucifolius* Sieb.

RUBIACEÆ: *Coprosma hirtella* Labill., *Asperula oligantha.*

COMPOSITÆ: *Olearia rosmarinifolia* A. Cunn., *O. viscidula* Benth., *O. elliptica* A. Cunn., (Shiny Leaf), *Brachycome multifida* DC., *Craspedia Richea* Cass., (Batchelor's Buttons), *Cassinia aculeata* R.Br., *C.* sp. (No. 2414), *Podolepis acuminata* R.Br., *P. canescens* A. Cunn., *Leptorrhynchos squamatus*, *Helichrysum bracteatum* Willd., (Everlasting Flower), *H. apiculatum*, *H. semipapposum* DC., *H. obcordatum* F.v.M., *Helipterum anthemoides*, *H. incanum* DC., *H. dimorpholepis* Benth., *Gnaphalium japonicum* Thunb., *Senecio lautus* Forst., var. *capillifolius* (*S. capillifolius* Hook.).

Candolleaceæ: *Candollea serrulata* Labill., (*Stylidium graminifolium* Sw., Trigger Flower).

Goodeniaceæ: *Goodenia geniculata* R.Br., *Dampiera* sp.

Campanulaceæ: *Lobelia* sp., *Wahlenbergia gracilis* (Blue Bell).

Epacrideæ: *Melichrus urceolatus* R.Br., *Brachyloma daphnoides* Benth., *Lissanthe strigosa* R.Br., *Leucopogon attenuatus* A.Cunn.,(at 4,500 feet), *Monotoca scoparia* R.Br.

Jasmineæ: *Notelæa microcarpa* R.Br.

Scrophularineæ: *Veronica Derwentia* Andr., (above 2,400 feet), *V. calycina* R.Br., *V.* sp., (a small plant like *V. gracilis*), *Euphrasia Brownii* F.v.M.

Bignoniaceæ: *Tecoma australis* R.Br., (Bignonia or Wonga Vine).

Myoporineæ: *Myoporum acuminatum* R.Br., (towards May Vale).

Labiatæ: *Scutellaria humilis* R.Br., *Prostanthera lasianthos* Labill., (Wild Lilac), *P. nivea* A. Cunn., (at 4,500 feet), *Ajuga australis*, *Oncinocalyx Betchei* F.v.M.

Plantagineæ: *Plantago varia* R.Br.

Polygonaceæ: *Muhlenbeckia rhyticarya* F.v.M.

Proteaceæ: *Persoonia* sp. (at 4,300 feet), *Hakea eriantha* R.Br., (at 4,300 feet), *H. microcarpa* R.Br., *Lomatia ilicifolia* R.Br.

Thymeleæ: *Pimelea glauca*, *P. linifolia* Sm., *P. pauciflora* R.Br., *P. curviflora*, *P.* sp. (No. 2383).

Euphorbiaceæ: *Poranthera microphylla* Brongn.

Urticeæ: *Urtica incisa* (Nettle).

Santalaceæ: *Exocarpus cupressiformis* Labill., (Native Cherry), *E. stricta* R.Br.

Coniferæ: *Callitris calcarata* (Black or Mountain Pine).

Cycadeæ: *Macrozamia heteromera* C. Moore, (with pinnæ divided at the ends. Not a common species).

Orchideæ: *Thelymitra ixioides* Sw., (?) (flowers smaller than in the type, and sepals not spotted), *Diuris maculata* Sm., *Prasophyllum patens* R.Br.

IRIDEÆ: *Patersonia sericea* R.Br., (Wild Iris), *Libertia paniculata* Spreng., (at 4,500 feet).

AMARYLLIDEÆ: *Hypoxis hygrometrica* Labill

LILIACEÆ: *Dianella revoluta* R.Br., *Eustrephus latifolius* R.Br., *Anguillaria* (*Wurmbea*) *dioica* R. Br., *Bulbine bulbosa* Haw., (at 4,500 feet), *B. semibarbata* Haw., *Stypandra glauca* R.Br., *Xerotes longifolia*, *Xanthorrhœa arborea* R. Br., (Grass Tree), *X.* sp. (No. 2369).

JUNCACEÆ: *Luzula campestris* DC., *Juncus homalocaulus* F.v.M., *J. pauciflorus* R.Br.

CYPERACEÆ: *Scirpus* sp., *Lepidosperma laterale* R.Br., *Carex inversa* R.Br., *C. appressa* R.Br.

GRAMINEÆ: *Andropogon affinis* R.Br., *Themeda Forskalii* Hack., (*Anthistiria ciliata* L., Kangaroo Grass), *Arundo Phragmites* Dod., *Poa cæspitosa* Forst.

FILICES: *Alsophila australis* R.Br., (Tree-Fern), *Adiantum Æthiopicum* L., (Maiden-Hair Fern), *Hypolepis tenuifolia* Bernh., *Cheilanthes tenuifolia* Sw., *Pellæa* (*Pteris*) *falcata* (R.Br.) Fée, (Fish-bone Fern, near The Waterfall), *Pteridium aquilinum* (L.) Kuhn, (*Pteris aquilina*, Bracken), *Blechnum discolor* (Forst.) Keys., (*Lomaria discolor*), *B. capense* (L.) Schlecht., (*Lomaria capense*), *Doodia aspera* Mett., *Asplenium flabellifolium* Cav., *Polystichum aculeatum* Sw., (*Aspidium aculeatum*).

One of the most attractive flowering plants found on the Nandewar Mountains, during the first week in November, was *Asterolasia correifolia* var *Muelleri*, which belongs to a genus closely allied to Eriostemon. This particular plant, which Bentham regarded as a distinct species, while Mueller considered it a variety of *A. correifolia*, is growing on Mount Kaputar, locally called Lindsay, above the 4,500 level and up to the summit of The Bluff at about 4,800 feet, occurring in masses about three feet high, and crowned with a profusion of beautiful bright yellow flowers. Var. *Muelleri* has much smaller leaves than *A. correifolia*, and these, as well as the branchlets, are more tomentose. The flowers of the former are yellow, while those of

the latter are white, and, as pointed out by Maiden and Betche, the stigma of the former is entire or nearly so, while that of the latter is more or less lobed, or nearly entire.*

The discovery of this variety of Asterolasia, on the Nandewar Mountains, is of special interest, as although it is not uncommon in Victoria, it has only once previously been recorded for New South Wales, having been collected by Mr. Forsyth at Lobb's Hole near Kiandra, in November, 1900. Its occurrence at Mount Lindsay extends its range northerly a distance of about 400 miles, and it still remains unknown to botanists in the intervening area.

In order to try and account for the present distribution of this plant, particularly its isolation on the Nandewar Mountains, several possible causes have to be considered, and the problem is difficult of final solution. Examples of isolated occurrences of plants, such as this, all furnish some slender evidence of what former land-surfaces or climatic conditions may have been, and an aggregation of similar facts, obtained by constant observation and collecting, largely assists in the solution of such problems.

Three of these possible causes, which suggest themselves, are: first, dispersal by birds; second, gradual spreading from parent-plants; and third, stranding through change of climate in intervening areas.

Possible distribution by birds is an important factor, which should never be overlooked, as seeds may be dispersed over a very wide area, and young plants may only grow where the conditions are suitable for the particular plant. This variety of Asterolasia, however, is so rare in New South Wales, that if its occurrence on Mount Lindsay is the result of dispersal by birds, it is difficult to understand why it does not occur in many more localities much less than 400 miles northerly from Kiandra. It is possible that it may have been overlooked in some spots, but various collectors have been over a great portion of this area, so that it is unlikely that its occurrence is other than rare within the limits mentioned.

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* J. H. Maiden, F.L.S., and E. Betche, These Proceedings, 1901, p.80; and 1902, p.56.

Little, therefore, can be said in favour of dispersal by birds being responsible for the distribution in this case.

The second suggestion, that it may have gradually spread from parent-plants, assisted by birds, presents certain points which are exceedingly difficult of proof, but nevertheless provide material for some interesting lines of thought. Adopting Mueller's opinion that this plant is only a variety of *A. correifolia*, which species occurs in the coastal area from about Sydney and the Nepean northwards, it might perhaps be considered a mountain-form which has climbed to its present height, and gradually developed differences owing to environment. Its present north and south extremes of range would then have to be regarded as having been connected through the coastal species. There are such large breaks in the continuity of this range of distribution, between coastal and mountain localities, so far as at present known, that this explanation cannot be considered as very satisfactory.

A further possibility and theory of its having gradually spread from parent-plants would involve its antiquity. Physiographers have reason to believe that, in early Tertiary time, New South Wales was an almost level tract of land, a peneplain, not raised much above sea-level; and that the mountains which form the present Main Divide, north and south, were not elevated until late Tertiary.* If *A. correifolia* had spread from the east coast, inland for two or three hundred miles prior to this uplift, and while the climatic conditions over that area were fairly uniform, then the occurrence, to-day, of resultant forms or varieties of that species in the elevated or western areas, with altered climatic conditions, would seem by no means an impossibility. In regard to the antiquity of the species, all that can be said at present, is that representatives of the genus are spread over, at least, parts of New South Wales, Victoria, and Western Australia, while the closely allied genus, *Eriostemon*, has representatives in all the

* "Geographical Unity of Eastern Australia," by E. C. Andrews, B.A. Journ. Proc. Roy. Soc. N. S. Wales, 1910, p.420. Presidential Address by C. Hedley, F.L.S., these Proceedings, 1911, p.13.

States of Australia, and one species in New Caledonia.† In this connection it is interesting to note that a third plant, *A. mollis* Benth., which is also regarded as a variety of *A. correifolia* by Maiden and Betche (These Proceedings, 1902, p.56), and which bears white flowers, occurs on the somewhat isolated Warrumbungle Ranges, a group of mountains lying just over 100 miles to the south-west of the Nandewars, and which, as pointed out by Dr. Jensen, bear close resemblance to them in their physiographic features, as well as being made up largely of alkaline rocks.

This hypothesis, therefore, that *A. correifolia* may have had an extensive range as far back as late Tertiary time, and that the varieties *Mulleri* and *mollis* are adaptations to environment as a result of the latest uplift, appears to have some reasonable grounds for consideration, which, however, must only be regarded as being put forth tentatively for the present.

The third suggestion, that the plants of var. *Mulleri* now found on the Nandewars may have become stranded owing to change of climate, seems also to be worthy of investigation. It must not be overlooked that the home of this variety to-day is in Victoria, largely in the Buffalo Ranges, and that, so far, it has only been recorded from two localities in New South Wales, one being fairly near Victoria, at Lobb's Hole, in the Kiandra district, and the other 400 miles northerly, but at an elevation of over 4,500 feet. Viewing the distribution of this plant or variety alone, there seems ground for assuming that, in prehistoric time, its range was more continuous between Kiandra and the Nandewars and that its disappearance from the intervening area may have resulted from some climatic change along this line. If it originated as a cold-loving plant, it may not be necessary to claim such great antiquity to account for its distribution, as it may have developed since the uplift in late Tertiary time.

A change of climate from cold to warm might have been produced in two ways: one being by a lowering of the mountain-levels by either tectonic movement or denudation, and the other by a general raising of temperature through the closing of a

† B.Fl., Vol. i., p.331.

glacial period. A structural study of the mountains between Kiandra and the Nandewars, points to the conclusion that, since the latest uplift, there has been no tectonic movement which has resulted in any general lowering of the surface throughout this area, consequently no modification of temperature has been effected in this manner.

Turning next to consider the possible effects of denudation, and seeing that the dissection of the mountains is still in a relatively youthful stage, as evidenced by the presence of gorges, the time-factor since the uplift does not seem to have been sufficiently great to admit of any considerable general lowering of summits by denudation such as would result in producing climatic changes. There is one local exception to this, as pointed out by E. C. Andrews* and by T. Griffith Taylor,† in the geologically recent formation of the Goulburn River valley, or Cassilis Geocol, which has resulted from the softness of the strata through which the river has had to cut. Considerable denudation in this locality is undeniable, though judging by the northerly and north-easterly dip of the strata towards this area from the southern side, it seems probable that the original site of this valley presented a slightly warped surface, or syncline, and was not uplifted quite as much as the New England and Blue Mountain plateaus. It would seem, therefore, that there may not have been much general lowering of mountain summits since the last uplift, and that the cause for climatic change must be looked for elsewhere.

It is suggested that sufficient change of climate to have allowed var. *Muelleri* to have occurred intermittently or perhaps continuously throughout the area extending from Kiandra to the Nandewar Mountains, may have been provided by the latest glacial period in Pleistocene time. Professor David has pointed out that the evidence of Pleistocene glaciation on Mount Kosciusko shows that there was a lowering of temperature of about 10° Fah., and that the snow-line came down about 3,000 feet

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* "Tertiary History of New England." By E. C. Andrews, B.A. Records Geological Society of N. S. Wales, Vol. 7 (1903), pp. 183-187.

† These Proceedings, 1906, p. 522.

(printed 300 erroneously) below its present limit.* Should the snow-line have come down only about 2,000 feet, with a consequent lowering of temperature of 6-7° Fah., such a change would have provided all the climatic conditions necessary for the spread of this particular variety of Asterolasia over practically all the present land-surface between Kiandra and Nandewar Mountains, and the closing of the glacial period, with the consequent warming of the climate, might have had the effect of gradually exterminating all the plants of this variety, excepting those at altitudes which still ensure cool conditions. This hypothesis, if correct, would show that var. *Muelleri* is a relic, or stranded plant, as a result of the termination of the last glacial period, but in our present state of knowledge nothing definite can possibly be said on the matter, though continued investigation of similar occurrences should assist in some solution of the problem.†

Another plant of considerable interest, in regard to its distribution, found towards the top of Mount Lindsay, is *Pultenæa setulosa,* which had never previously been collected in New South Wales. It grows in masses about 5-6 feet high, and is covered with yellow flowers during the first week in November. Its previously known habitat is Broad Sound, Queensland, about 750 miles northerly from the Nandewar Mountains, though it probably occurs in portions of the unexamined intervening area.

Eight species of Acacia were noticed between the 3,000 and 5,000 feet levels, *A. dealbata* occurring on the actual summit of Mount Kaputar at about 5,000 feet, while *A. rubida* and *A. melanoxylon* were found up to 4,900 feet. *A. armata* was seen up to an altitude of about 2,500 feet, and *A. neriifolia* ascends to about 3,000 feet. This latter species, like *A. rubida,* retains its juvenile foliage (pinnate leaves) until the shrubs are 6-8 feet high, and this dimorphic foliage often assists in the identification of the plant. *A. neriifolia* is well worthy of cultivation as a Golden Wattle, as it

* "Geological Notes on Kosciusko, with Special Reference to Evidences of Glacial Action." By T. W. Edgeworth David, B.A., F.R.S., etc. These Proceedings, 1908, p.668.

† See remarks by Mr. A. G. Hamilton, in regard to the occurrence of *Eucalyptus globulus* near Mudgee. These Proceedings, 1887, p.260.

bears a profusion of blossoms which are of a darker yellow colour than those of many Acacias. Its flowering time is about the first of September.

*Eucalyptus coriacea,* the Snow-Gum of Kosciusko, was found on alkaline rocks from the 4,600 feet level up to the actual summit of Mount Lindsay or Kaputar, the later being about 5,000 feet above sea-level. This is the Eucalypt which climbs above all others in New South Wales, and reaches the greatest altitude of any Eucalypt in Australia. In various isolated situations, as on some of the narrowest parts of the Liverpool Range, and on the Nandewar Mountains, its occurrence is suggestive of its being a relic or stranded plant. Although it reaches an elevation of 6,500 feet on Mount Kosciusko,* it by no means takes the highest land in Tasmania, being absent from the summit of Mount Wellington (4,166 feet), and also from the summit of Mount Roland at nearly 4,000 feet, where it was specially searched for by Mr. E. C. Andrews and myself in February, 1911. On Mount Roland, rather stunted forms of *E. Gunnii* Hk., and *E. coccifera* Hk.,are common, while *E. coccifera* and *E. vernicosa* Hk., occur on the summit of Mount Wellington.

Taking those plants which are common to the coldest parts only of this State, and to Tasmania, my observations go to show that such plants require an increased minimum altitude of about 1,000 feet for every 300-330 miles in their distribution northerly from Tasmania to northern New South Wales. *E. coriacea* is one of these cold-loving plants, and as the direct distance from Hobart to Mount Kosciusko is about 450 miles, the presence of this Snow-Gum at 6,500 feet on Kosciusko should imply its occurrence in Tasmania at levels up to about 5,000 feet, provided the geological formation and aspect were suitable. So far as the former is concerned, the rocks of Mount Wellington appear such as would support the growth of this species in New South Wales, while those of Mount Roland may be too acid. This Snow-Gum is also a lover of open country, usually avoiding scrubby land, and will, in some situations, occupy large areas almost exclusively. It may, therefore, be

* J. H. Maiden, F.L.S., Agricultural Gazette of N. S. Wales, 1899.

absent from some localities because other plants have obtained possession, and, following the law of the "survival of the fittest," retain such possession to the exclusion of the Snow-Gum.

*E. albens* was found flowering on the Nandewar in November, at an altitude of about 2,800 feet, its usual flowering period in the western districts being in the autumn. As an evidence of the effect of climate on plant distribution, it may be mentioned that south of the Murrumbidgee, this species is usually below an elevation of 1,500 feet, while at a point on the Nandewars, about 350 miles northerly, it is able to reach an altitude about 1,300 feet higher.

The discovery of *E. dives,* the Peppermint of our western mountains, on Mount Lindsay, is of very great interest, as hitherto it had been considered by botanists to be restricted to the southern side of the Hunter Valley. It was shortly afterwards (December, 1909) collected by Mr. J. L. Boorman at Guy Fawkes, east of Armidale, the specimens being now in the National Herbarium, Botanic Gardens, Sydney. This species, although a mountain plant, rather prefers the western to the eastern aspect in New South Wales, and extends from the Nandewars southerly at least as far as Ballarat in Victoria. It is usually found at elevations from about 2,000 feet upwards in this State, some of its lowest points of occurrence being in the Goulburn to Yass district. On Mount Lindsay it was found intermittently from about 3,500 to 4,500 feet, but does not occur on the summit.

It had always seemed remarkable that *E. dives* had not been recorded from New England, and its absence from that locality had been previously attributed to its inability to cross the comparatively warm valley of the Goulburn River, a tributary of the Hunter. The Liverpool Range, in which the Goulburn River rises, is in one place only about 1,700 feet above sea-level, which appears to be too low for the growth of *E. dives* in latitudes north of Sydney; and the Main Divide for many miles, where it winds past Murrurundi towards New England, is very narrow, in places amounting to only a few hundred yards, thus reducing the possibilities of this tree spreading on to New England. Another point is that the higher parts of the Liverpool Range are largely capped

with basalt, a basic rock which *E. dives* always avoids, preferring a sedimentary formation considerably acid, but not necessarily containing a high proportion of free silica.

In order to flourish in the latitude of Mount Lindsay, this Peppermint would probably require an altitude of nearly 3,000 feet, and as most of the country between the Liverpool Range and the Nandewar Mountains including part of the Liverpool Plains, is much below that elevation, its occurrence on the latter mountain is difficult to explain. There is, however, a much denuded range running north-westerly past Currabubula, known as the Peel Range, and connecting the Nandewar Mountains with the Liverpool Range to the north of Murrurundi, through a gap in which the Namoi River passes near Carroll, and *E. dives* may possibly have spread from the south along this range, although it is now, for the most part, not sufficiently elevated for the growth of this species. Considering the amount of basic rock, however, on the high land between Coolah or Cassilis and Murrurundi, its passage along this stretch of the Liverpool Range for such a great distance, 60-70 miles, on to the Peel Range would be very difficult of explanation. At present, there is no record of this species between the Mudgee district and the Nandewars, a distance of about 150 miles, and it is difficult to understand how it ever could have occurred continuously under present climatic conditions, without the intervening hills had been formerly much higher than now.

There is the possibility, which seems not unreasonable, that the species may have spread to the Nandewar Mountains towards the close of the glacial period in Pleistocene time, but the evidence in support of this theory is very meagre. At the same time this hypothesis is supported by the fact that there is another southern plant, viz., *Asterolasia correifolia,* var. *Muelleri,* in company with this tree, which was hitherto unknown as far north, and the probability of their isolation being due to accidental dispersal by birds becomes, therefore, somewhat discounted. However, *E. dives* has, by some means, reached the Nandewars, and is sparsely represented on southern New England, but its rarity in the latter locality is possibly largely owing to the fact that much of the geological for-

mation along the Main Divide, extending from Cassilis to southern New England, is of too basic a character to support the growth of this particular Peppermint. The curious distribution of this tree in the north, furnishes an interesting subject for investigation, which might be considered in conjunction with the study of local physiographic problems, and climatic changes.

*E. Cambagei* was found unexpectedly on Mount Lindsay, extending from about the 3,500 feet level to nearly 4,900 feet, or practically on the summit. In its distribution, this species is not unlike *E. dives,* favouring the western side of the Main Divide and extending into Victoria, but descending to lower levels, and sometimes growing on more basic formations. Its most northern limit previously known to me was near Murrurundi, and close to the Liverpool Range, where it is growing on basaltic formation at an elevation of about 1,500 feet; but I have recently found it at Currabubula, on Carboniferous formation, at an altitude of 2,500-2,900 feet. It is remarkable that, so far, this tree has not been recorded from New England, while, however, it has found its way to the Nandewars, and should be looked for in the Nundle Swamp Oak district, on the southern portion of New England. (For previous remarks concerning this species, see these Proceedings for 1902, p. 199.)

*E. Andrewsi* and *E. nova-anglica* were found at about the 3,000 feet level, the former on the acid, volcanic agglomerate formation, and the latter on the alluvial flats near the Horton River. The occurrence of these two species in this locality is of interest, as neither has been recorded south of the Hunter Valley, and both are regarded as typical New England trees. They have, however, found their way westward to the Nandewars, although some of the intervening country is lower than the elevations at which they usually flourish. Curiously they have here met with two southern Eucalypts which do not occur on northern New England, viz., *E. dives* and *E. Cambagei,* although owing to considerations of soil and moisture requirements they do not actually associate with them, though only separated by a mile or so. (For previous remarks concerning *E. Andrewsi* and *E. nova-anglica,* see these Proceedings for 1904, pp. 791, 795.)

The finding of *E. Bancrofti* (*E. tereticornis* var. *brevifolia*) on mountains chiefly composed of alkaline rocks, was a matter for some surprise, as the species is one which appears to thrive only where there is an abundance of free silica. It was first noticed between May Vale and Mount Lindsay Station, and was growing on basalt, a basic rock with a minimum of free silica. As this was such an unusual occurrence, some investigation was made, which resulted in disclosing the fact that the basalt was thin, and was overlying extensive beds of acid, volcanic agglomerate, into which the roots had, no doubt, penetrated. In cases of this kind it is not unlikely that many seeds would germinate in the basalt, but only those plants would eventually survive which happened to be provided with suitable drainage until their roots reached the siliceous rocks below. The species, which throughout, had very glaucous buds, was afterwards found on other areas of acid agglomerate formation. The presence of this tree may be taken as an indication that the rock upon which it is growing contains upwards of 70 per cent. silica. (For previous remarks, see these Proceedings, 1908, p. 55.)

*Coprosma hirtella* was noticed on the summit of Kaputar at an altitude of about 5,000 feet. This is a typical Tasmanian plant, and has been recorded as far north as the Blue Mountains, but according to specimens kindly shown me by Mr. Maiden, it occurs on Bald Hills Station, about 65 miles easterly of Armidale; and on the 17th April, 1843, was collected by Dr. Leichhardt at the head of the Gwydir River. Members of this genus are most numerous in New Zealand, and the Australasian species are found chiefly in the colder parts.

*Oncinocalyx Betchei,* a somewhat rare plant of a few feet high, was found just above the 3,000 feet level, northerly from the homestead, and about half a mile southerly from The Waterfall.

On the summits of Mount Lindsay and the hill across the gorge to the north-east, at 4,500 feet, an almost aborescent form of *Lomatia ilicifolia* was noticed, growing to a height of about 8-10 feet, with stems 2 inches in diameter.

An interesting little Pimelea shrub (No. 2383), with glabrous flowers, is growing on Mount Lindsay at about 4,500 feet, but, in the absence of fruiting specimens, has not been identified.

A species of Xanthorrhœa (No. 2369, Grass-Tree) with a caudex of a few inches, and a flowering spike of 1 foot 9 inches, was found near the homestead at an altitude of about 3,000 feet. It differs from described New South Wales species in having quadrangular leaves, which are about 1 foot 8 inches long, and in this respect, though differing in others, somewhat resembles *X. quadrangulata* F.v.M., of the Mount Lofty Ranges in South Australia.

Among the hills across the gorge to the north-east of Mount Lindsay, and quite concealed from west winds, is a picturesque glen, which is beautified by a number of graceful Tree-Ferns (*Alsophila australis*). The altitude of the spot is about 3,700-4,000 feet, and I know of no place in this State, where this Tree-Fern occurs so far westerly of the Main Divide, and which, in this instance, is about 90 miles.*

*Head of Maule's Creek to Boggabri.*

The following notes refer to the country extending from the valley in which the head-waters of Maule's Creek collect, at about 2,000 feet above sea-level, and past the old Willuri woolshed to Boggabri at 820 feet. Maule's Creek takes its rise in the south-eastern portion of the Nandewar Mountains, and flows, first southerly and then westerly, to the Namoi River, joining it about a dozen miles below Boggabri. In the earlier part of its westerly course, it passes between sandstone escarpments (Plate lxvii.) of probably Permo-Carboniferous age, extending for several miles, and this portion of the creek was followed by me, after which a direct course was taken across the flat country south-westerly to Boggabri.

The first explorer to visit this locality was Sir Thomas L. Mitchell, and according to his journal he discovered Maule's Creek on the

* His Honor Judge Docker informs me that there are some Tree-Ferns in a sheltered nook on the Warrumbungles, but though south-westerly from the Nandewars, this spot is closer to that portion of the Main Divide which sweeps round from Murrurundi to Cassilis.

18th December, 1831, and named it on the following day; though after whom he named it is not stated. On this journey, he followed the right bank of the Namoi River, and also of the lagoon or billabong, just east of Boggabri. Mitchell clearly shows that Namoi, which he spelt "Nammoy," is the native name of the river below the junction of the Conadilly. Special mention is made of a remarkable peak, which he had first seen from a distance of about 25 miles, the native name of which is Tangulda, and which is now identified as Barber's Pinnacle, north of Wilberoi House (Plate lxvi.).* A list of the flora on this peak is given in this paper.

After proceeding north-east by north from Barber's Lagoon, for over 20 miles towards the Nandewars, Mitchell found the country beyond Maule's Creek almost inaccessible for horses, and returned. He then continued his journey down the Namoi, passing eastward of Narrabri, and thence northerly, until reaching the Gwydir some 6-8 miles above Moree.

On the 2nd January, 1832, somewhere to the eastward of Narrabri, Mitchell discovered the species which was afterwards named *Capparis Mitchelli,* and specially remarks that he only saw one tree of it during the whole of the expedition. He next found it on the Lower Bogan in 1835 (Vol. i., p. 284). The species is not uncommon in the Boggabri district.

The following plants were found chiefly between the head of Maule's Creek and Boggabri, by far the greater number occurring below an altitude of 1,200 feet:—

Ranunculaceæ: *Clematis aristata* R.Br., *C. microphylla* DC., *Ranunculus lappaceus* (Buttercup).

Dilleniaceæ: *Hibbertia linearis*, var. *obtusifolia.*

Papaveraceæ: *Argemone mexicana* L., (Mexican Poppy. Naturalised), *Papaver horridum* DC.

Cruciferæ: *Capsella bursa-pastoris* Mœnch (Shepherd's Purse), *Lepidium pseudo-ruderale* Thell., *Senebiera didyma* Pers., (Pepper-wort, naturalised).

Capparideæ: *Capparis Mitchelli* Lindl., (Wild Orange), *Apophyllum anomalum* F.v.M., (Warrior or Currant-bush).

* Mitchell's Eastern Australia, Vol. i., pp. 47, 51.

VIOLARIEÆ: *Viola hederacea.*

PITTOSPOREÆ: *Pittosporum phillyræoides* DC., *Bursaria spinosa* Cav.,(Blackthorn).

CARYOPHYLLEÆ: *Stellaria glauca* With., *S. flaccida* Hk.

HYPERICINEÆ: *Hypericum gramineum.*

MALVACEÆ: *Sida corrugata* Lindl., and vars. *orbicularis*, *pedunculata* and *angustifolia*, *Hibiscus Sturtii* Hk.

STERCULIACEÆ: *Sterculia diversifolia* (Currajong), *Melhania incana* Heyn.,(evidently rare in New South Wales and belongs to the interior).

LINEÆ: *Linum marginale* A. Cunn.,(Australian Flax Plant).

GERANIACEÆ: *Erodium cygnorum* Nees, *Oxalis corniculata* (Sour Grass).

RUTACEÆ: *Eriostemon difformis* A. Cunn.,(on sandstone hills west of Boggabri), *Correa speciosa* (Maule's Creek), *Geijera parviflora* Lindl.,(Wilga).

CELASTRINEÆ: *Celastrus Cunninghamii* F.v.M.

STACKHOUSIEÆ: *Stackhousia muricata* Lindl., *S. viminea*, *S. spathulata* Sieb.

RHAMNEÆ: *Alphitonia excelsa* Reiss.,(Red Ash).

SAPINDACEÆ: *Nephelium subdentatum* F.v.M., *Heterodendron oleæfolium* Desf.,(Rosewood), *Dodonæa viscosa* and var. *spathulata* (Hopbush), *D. tenuifolia* Lindl., *D. boroniæfolia* G. Don.

LEGUMINOSÆ: Suborder i., PAPILIONACEÆ; *Hovea linearis*, *H. longifolia* R.Br.,(a charming little shrub when covered with purple flowers in spring), *Psoralea adscendens* F.v.M., var. *parva* Benth., (*P. parva* F.v.M.), *Indigofera australis* and var. *signata*(Indigo), *Swainsona coronillifolia* Salisb.,(commonly called Darling Pea), *S. luteola* F.v.M., *Hardenbergia monophylla*, *Melilotus parviflorus* Desf.,(naturalised).

Suborder ii., CÆSALPINIEÆ: *Cassia australis* Sims, *C. eremophila* A. Cunn.

Suborder iii., MIMOSEÆ: *Neptunia gracilis* Benth., (a small sensitive plant on the plains), *Acacia triptera* Benth., (Wait-a-While), *A. armata*, *A. neriifolia* (up Maule's Creek), *A. hakeoides* A. Cunn.(about 15 miles N.E. of Boggabri), *A. salicina* Lindl.,(the Cooba of the Lachlan River, up Maule's Creek), *A. decora* Reichb.,

*A. homalophylla* A. Cunn.,(Yarran), *A. pendula* A.Cunn., (Myall), *A. Oswaldi* F.v.M., *A. implexa* Benth., *A. Cunninghamii* Hk.,(Curracabark, on Barber's Pinnacle and other hills), *A. dealbata* (not the glaucous form found on the mountains).

Rosaceæ : *Rubus parvifolius.*

Crassulaceæ : *Tillæa verticillaris.*

Haloragæ : *Haloragis elata* A. Cunn.

Myrtaceæ : *Calythrix tetragona* (on hills east of Boggabri), *Melaleuca bracteata* F.v.M.,(along the banks of Maule's and Goonbri Creeks. Identified by Mr. R. T. Baker*), *Angophora intermedia* (Apple Tree), *Eucalyptus melliodora* (Yellow Box), *E. populifolia* Hook., )Bimble or Shiny-leaved Box), *E. albens* (White Box), *E. Woollsiana* R. T. Baker (Narrow-leaved Box), *E. melanophloia* (Silver-leaved Ironbark), *E. crebra* (Narrow-leaved Ironbark), *E. dealbata* F.v.M., *E. rostrata* Schl.,(River Red-gum), *E. tereticornis* (Forest Red-gum), *E. Bridgesiana* (only seen on upper part of Maule's Creek), *E. viridis* R. T. Baker,(Mallee, on sandstone hills three or four miles west of Boggabri).

Onagrarieæ : *Jussiæa repens* L.,(an aquatic plant with beautiful, yellow, buttercup-like flowers, on the Lagoon near Wilberoi).

Cucurbitaceæ: *Cucumis myriocarpus* Naud.,(Native Melons).

Umbelliferæ : *Eryngium rostratum* Cav., var. *paludosum*, *Daucus brachiatus* Sieb.

Loranthaceæ : *Loranthus linophyllus* Fenzl, (on *Casuarina Cunninghamiana*), *L. pendulus* Sieb.,(on *Eucalyptus crebra*), *L.* sp.(on *Santalum lanceolatum*).

Rubiaceæ : *Canthium oleifolium* Hk., (often called Wild Lemon, and covered in early November with a profusion of strongly sweet-scented, white flowers), *Asperula oligantha.*

Compositæ: *Centaurea melitensis* L.,(Saucy Jack. Naturalised), *Olearia elliptica, Calotis microphylla* Benth., *C. lappulacea* Benth., *Brachycome graminea* F.v.M.,(a very tall form, 20 inches high), *Siegesbeckia orientalis* Linn., *Cotula australis* Hk., *Craspedia*

* See a paper "On the Australian Melaleucas and their Essential Oils," by R. T. Baker, F.L.S., and H. G. Smith, F.C.S., Journ. Proc. Roy. Soc. N. S. Wales, 1910, p.601.

*Richea* (Batchelor's Buttons), *Cassinia* sp., *Leptorrhynchos squamatus, Helichrysum apiculatum, H. semipapposum, H. obcordatum* F.v.M., *H.* sp., *Helipterum anthemoides, H. dimorpholepis, Gnaphalium japonicum, Senecio capillifolius* Hk., *Carduus pycnocephalus* L.,(naturalised).

Goodeniaceæ : *Velleya paradoxa, Goodenia glauca* F.v.M., *G. ovata* Sm.

Campanulaceæ : *Lobelia pedunculata* R.Br., *Isotoma axillaris* Lindl., *Wahlenbergia gracilis*(Blue Bell).

Epacrideæ : *Melichrus urceolatus.*

Primulaceæ: *Anagallis arvensis* L.,(Pimpernel. Naturalised).

Jasmineæ: *Jasminum suavissimum* Lindl., *Notelœa microcarpa, N. linearis* Benth.

Apocyneæ : *Alstonia constricta* F.v.M., (Quinine or Bitter Bark), *Lyonsia cucalyptifolia* F.v.M. (a tall woody climber).

Gentianeæ : *Erythræa australis* R.Br., *Limnanthemum crenatum* F.v.M.,(an aquatic plant with orbicular leaves, and beautiful yellow, fringed flowers, upwards of one inch in diameter. In Barber's Lagoon).

Boragineæ : *Cynoglossum australe* R.Br.

Convolvulaceæ : *Convolvulus marginatus* Poir.

Solaneæ : *Solanum esuriale* Lindl., *S. cinereum* R.Br., *S. rescum* F.v.M., *S. parvifolium,* R.Br., *Nicotiana glauca* (a tobacco-plant introduced from South America).

Scrophularineæ : *Mimulus gracilis* R Br.,(little blue flowers growing in clusters on the plains), *Morgania glabra* R.Br., *Verbascum blattaria* L.,(naturalised).

Bignoniaceæ : *Tecoma australis*(Wonga Vine).

Acanthaceæ : *Justicia procumbens* Linn.

Myoporineæ : *Myoporum platycarpum* R.Br., *Eremophila Mitchelli* Benth.,(Budtha or Budda, sometimes called Sandalwood), *E. longifolia* F.v.M.

Verbenaceæ : *Verbena officinalis* L.

Labiatæ: *Scutellaria humilis. Prostanthera rotundifolia* R.Br., *Ajuga australis, Oncinocalyx Betchei* (on Robertson's Mountain), *Stachys arvenis* L.,(Stagger-weed, naturalised).

Plantagineæ : *Plantago varia.*

PHYTOLACCACEÆ: *Codonocarpus australis* A. Cunn., ("Bell Fruit." On hills east of Boggabri).

CHENOPODIACEÆ: *Rhagodia hastata* R.Br.,(Saltbush), *R. nutans* R.Br., *R. linifolia* R.Br., *Kochia mierophylla* Moq., (Cotton-bush).

AMARANTACEÆ: *Ptilotus exaltatus* Nees, *Alternanthera triandra* Lam.

POLYGONACEÆ: *Rumex Brownii* Campd., *Polygonum minus* Huds.

NYCTAGINEÆ: *Boerhaavia diffusa* L.,(Tarvine, an excellent fodder plant).

PROTEACEÆ: *Hakea leucoptera* R.Br.,(Needlewood).

THYMELEÆ: *Pimelea glauca*, *P. pauciflora*, *P. curviflora*.

EUPHORBIACEÆ: *Euphorbia Drummondii* Boiss., *Beyeria viscosa* Miq., *Phyllanthus subcrenulatus* F.v.M., *P. thesioides* Benth.,(on Ironbark hills, 10-12 miles N.E. of Boggabri. Rare in New South Wales.) *Breynia oblongifolia* J. Muell., *Adriana tomentosa*.

URTICEÆ: *Trema cannabina* Lour., *Ficus rubiginosa* Desf., (Figtree), *Urtica incisa*(Nettle).

CASUARINEÆ: *Casuarina Cunninghamiana*(River Oak, along the banks of Maule's Creek and the Namoi River), *C. Cambagei* R. T. Baker,(Belah, regarded by Mr. Maiden as *C. lepidophloia* F.v.M.,*), *C. Luehmanni* R. T. Baker(Bull Oak).

SANTALACEÆ: *Santalum lanceolatum* R.Br., *Exocarpus cupressiformis*(Native Cherry), *E. aphylla* R.Br.

CONIFERÆ: *Callitris robusta* R.Br.,(White or Cypress Pine. Regarded as *C. glauca* R.Br., by Mr. R. T. Baker),† *C. calcarata* (Black or Mountain Pine).

ORCHIDEÆ: *Cymbidium canaliculatum* R.Br.

LILIACEÆ: *Dianella revoluta*, *Eustrephus latifolius*, *Anguillaria* (*Wurmbea*) *dioica*, *Bulbine bulbosa*, *B. semibarbata*, *Stypandra glauca* R.Br., *Arthropodium strictum* R.Br., *Xerotes longifolia*, *Xanthorrhoea* sp. (No. 3603, with almost quadrangular leaves, on Robertson's Mountain).

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* Forest Flora of N. S. Wales, by J. H. Maiden, F.L.S., Part xiii., p.74.

† See "A Research on the Pines of Australia," by R. T. Baker, F.L.S., and H. G. Smith, F.C.S.

JUNCACEÆ: *Juncus pauciflorus*, *J. pallidus* R.Br.,(Rushes).

NAIADEÆ: *Potamogeton crispus* Linn.

CYPERACEÆ: *Cyperus gracilis* R.Br., *C. concinnus* R.Br., *C. vaginatus*, *C. fulvus* R.Br., (a viscid form with long spikelets), *Lepidosperma laterale*, *Carex inversa*, *C. Gaudichaudiana* Kunth, *C. appressa*.

GRAMINEÆ: *Andropogon sericeus* R.Br., *A. affinis* R.Br., *Themeda Forskalii* (*Anthistiria ciliata*, Kangaroo-Grass), *Stipa verticillata* Nees, *S. aristiglumis* F.v.M., *S. scabra* Lindl., (Silver Grass), *Deyeuxia Forsteri* Kunth, *Danthonia penicillata* F.v.M., *Chloris truncata* R.Br., (Umbrella-Grass), *Arundo Phragmites*, *Poa caespitosa*, (White tussocks), *Bromus arenarius* Labill., *Festuca bromoides* Linn.,(naturalised), *Hordeum murinum* L.,(Barley Grass, naturalised).

MARSILEACEÆ: *Marsilea Drummondii* A.Br.,(in damp places on the plains, and often known as Nardoo).

FILICES: *Adiantum Aethiopicum* (Maiden-hair Fern), *A. hispidulum* Sw.,(under sandstone cliffs near Maule's Creek), *Cheilanthes tenuifolia*, *Pellaea* (*Pteris*) *falcata*, *Pleurosorus* (*Grammitis*) *rutæfolius* (R.Br.), Fée.

### *Tangùlda or Barber's Pinnacle.*

(Plate lxvi.)

The hill now known as Barber's Pinnacle, is a conspicuous peak of decomposing rhyolite, rising about 360 feet above the level of the surrounding plain. Upon it the following plants were noticed:—

*Clematis microphylla*, *Bursaria spinosa*, *Melhania incana*, *Geijera parviflora*, *Alphitonia excelsa*, *Heterodendron oleæfolium*, *Hardenbergia monophylla*, *Acacia decora*, *A. Cunninghamii*, *Haloragis elata*, *Angophora intermedia*, *Eucalyptus albens*, *E. melanophloia*, *E. dealbata*, *Loranthus* sp.,(on *Geijera parviflora* and *Santalum lanceolatum*), *Canthium oleifolium*, *Helichrysum obcordatum*, *Isotoma axillaris*, *Wahlenbergia gracilis*, *Notelaea microcarpa*, *Cynoglossum australe*, *Verbascum blattaria*, *Tecoma australis*, *Prostanthera rotundifolia*, *Rhagodia hastata*, *Kochia microphylla*, *Beyeria viscosa*, *Ficus rubiginosa*, *Urtica incisa*, *Santalum*

*lanceolatum, Exocarpus cupressiformis, Callitris robusta, Xerotes longifolia, Cyperus fulvus, Lepidosperma laterale, Stipa verticillata, S. scabra, Cheilanthes tenuifolia.*

A species of some interest in regard to distribution, which is growing on Barber's Pinnacle and other hills, and also near the upper portion of Maule's Creek, is *Alphitonia excelsa,* the Red Ash of the coastal district; and the little trees are easily identified by the clusters of berry-like fruits, and leaves with an almost white underside. The fact that this species will flourish in the brush-lands of the moist coast, in places where there is an annual rainfall of 50 inches, and also in the much drier west, where the rainfall is reduced to about 24 inches annually, is evidence of its adaptability to environment.

It seems undoubted that this species has worked its way into New South Wales from the north. It is recorded from several islands off the north and north-east coast of Australia, amongst others being Borneo, Celebes, New Guinea, New Caledonia, Hawaii and Fiji,* and is known to occur in various portions of Eastern Queensland; but on coming into New South Wales, the cold heights of the Main Divide have caused it to spread westwards towards Boggabri on the one hand, and along the coastal eastern slopes on the other, where it appears to reach its greatest southerly extension. At the same time it is known to occur in various localities in the Goulburn and Hunter River Valleys near the Liverpool Range, and this range is sufficiently low in places to allow this plant access to both sides. Its most southern point known to me is Milton, where it is growing on a doleritic basalt formation, containing under 55 % silica, while at Boggabri it is found on acid rocks, some of which contain an abundance of free silica.

Whether this species had the same range east and west, in this State, prior to the final uplift in late Tertiary time, or has spread along both sides of the Main Range since that period, there does not appear to be at present definite evidence to show; but considering the great similarity between the eastern and western forms, its

*"The Montane Flora of Fiji," by Lilian S. Gibbs, F.L.S., Journ. Linn. Soc. London, 1909, p. 143.

somewhat limited extent east and west, and present possibilities of migration to the places where it now occurs in this State, it seems probable that much of this distribution has occurred under conditions of present-day topography.

*Melaleuca bracteata* is the common Tea-tree along the creeks north-east of Boggabri, growing in groups or clusters up to 20 feet high, and flowering late in November. The clustering habit of these trees causes a bending over and bunching of the heads, which render them useful for shade purposes. (Plate lxvii.)

The presence of such trees as *Acacia pendula* (Myall), and *Eucalyptus populifolia* (Bimble or Shiny-leaved Box), east of Boggabri, shows that typical western conditions come eastward to this locality, which marks a point on the eastern margin of the habitat of both these species.

*Ficus rubiginosa,* usually a moist-climate or coastal tree, is well established on the dry summit of Barber's Pinnacle, and on other hills.

The selective qualities of plants, when seeking suitable conditions for subsistence, are exemplified in the Eucalypts and other genera around Boggabri, and accord with what may be seen in a similar climate elsewhere in this State. Certain trees find it necessary that their roots should reach abundant moisture, while others have adapted themselves to subsist where the soil-moisture is slight indeed. Taking the three conditions of moisture at Boggabri, viz., that of the river-banks, the alluvial flats, and the hills, it is found that the river-banks are occupied by *Eucalyptus rostrata,* while the flats are covered with *E. populifolia, E. Woollsiana, E. melliodora* and *E. tereticornis,* the hills and even slight ridges being the home of *E. albens, E. crebra, E. melanophloia, E. dealbata* and *E. viridis.*

The local Casuarinas have distributed themselves in the following manner:—*C. Cunninghamiana* along the river-banks, *C. Cambagei* on the flats, and *C. Luehmanni* on the elevations. Other genera descriminate in a similar manner.

From a study of this distribution, and adaptation to environment, it is easy to conceive how a process of evolution may be

originated by earth-movements or climatic changes, as well as by the proximity of different geological formations.

*Percentage of Tasmanian Plants.*

Of about 210 species noticed around Boggabri, at elevations from about 800-1,200 feet above sea-level, 36 % chiefly of the smaller plants, are recorded from Tasmania, which, considering the disparity of climates, seems a fairly high percentage; while, on the Nandewar Mountains, at altitudes varying from 3,000-5,000 feet, and with much greater similarity of climates, 60 % of about 160 species seen, occur in Tasmania. This affords an instructive example of the regulating influence of climate on plant-distribution.

It is also worthy of note that not a single Eucalypt, and only one Acacia noticed around Boggabri, in a warm, fairly dry climate, are known to occur in Tasmania; while only two species were found of each of these genera, which are common to both Tasmania and the Nandewars.

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## EXPLANATION OF PLATES.

Plate lxvi.

Tangùlda or Barber's Pinnacle, Boggabri.

Plate lxvii.

Groups of *Melaleuca bracteata* F.v.M., and Permo-Carboniferous(?) sandstone cliffs, Maule's Creek.